Texas Department of Transportation

July 2004

Houston HOT Lane Network
Detailed Plan

Proposal to:

Federal Highway Administration, Value Pricing Pilot Program

Proposed by:

Texas Department of Transportation

This value pricing proposal for a Houston HOT Lane Network has been developed in accordance with the application guidelines for the Value Pricing Pilot Program authorized by Section 1216 (a) of the Transportation Equity Act for the 21st Century (TEA-21) in the Federal Register Document from May 7, 2001, Volume 66, Number 88, Page 23077 - 23081. Included in this proposal are estimated expenses for each of the anticipated tasks. Note that these are cost estimates and may need to be refined. This plan outlines the pre-project activities necessary prior to project implementation. It is anticipated that an implementation project would commence after the completion of this study, in 2 years. The total anticipated cost is $575,000.

1. Congestion Problem to be Addressed

The Houston area experiences severe traffic congestion and is currently the 6th most congested city in the United States (Urban Mobility Study, Texas Transportation Institute, 2003). Additionally, Houston is expected to continue its rapid growth, resulting in continuing pressure on Houston's freeways in the future. The Texas Department of Transportation (TxDOT), Houston METRO, and the Harris County Toll Road Authority (HCTRA) are working together to reduce traffic congestion through innovative solutions and partnerships. Two innovative projects include: (1) the High Occupancy/Toll (HOT) lanes on the Katy and Northwest Freeways and (2)

the reconstruction of Katy Freeway with managed lanes. These agencies will continue to look for innovative methods to further reduce traffic congestion in Houston.

More specifically, this proposal will examine the network of HOV lanes in Houston (see Figure 1). Traffic congestion during peak periods on the mainlanes of freeways with HOV lanes is generally quite severe resulting in a level of service F and poor travel speeds (for example see Figure 2). Although generally the case, there are instances where the freeway mainlanes are not severely congested and there is excess capacity on the HOV lane. These situations result in several scenarios where the HOV lanes can be converted to HOT lanes to improve the overall person-movement in the corridor – in some cases by reducing congestion on the HOV lane and in other cases by allowing more vehicles on an underutilized HOV lane. Thus plans to optimize the entire network of HOV (or HOT) lanes to provide the maximum benefits for Houston travelers through reduced congestion and delays will be developed.

2. Description of Proposed Pricing Program and Its Goals

The proposed project will examine Houston's six HOV lanes with a goal of developing a detailed implementation plan for a HOT lane network (or HOT network). This will include a plan to expand current HOT activities on Katy and Northwest Freeways and add tolling to the other 4 HOV lanes to develop an integrated network of HOT lanes. The six HOV lanes (see Figure 1) are located on:

1. North Freeway (I-45 north of downtown),
2. Katy Freeway (I-10 west of downtown),
3. Gulf Freeway (I-45 south of downtown),
4. Eastex Freeway (US 59 north of downtown),
5. Southwest Freeway (US 59 south of downtown), and
6. Northwest Freeway (US 290 northwest of downtown).

All of these HOV lanes are barrier separated, have adjacent park and ride lots, and have significant transit usage; many have direct freeway access.

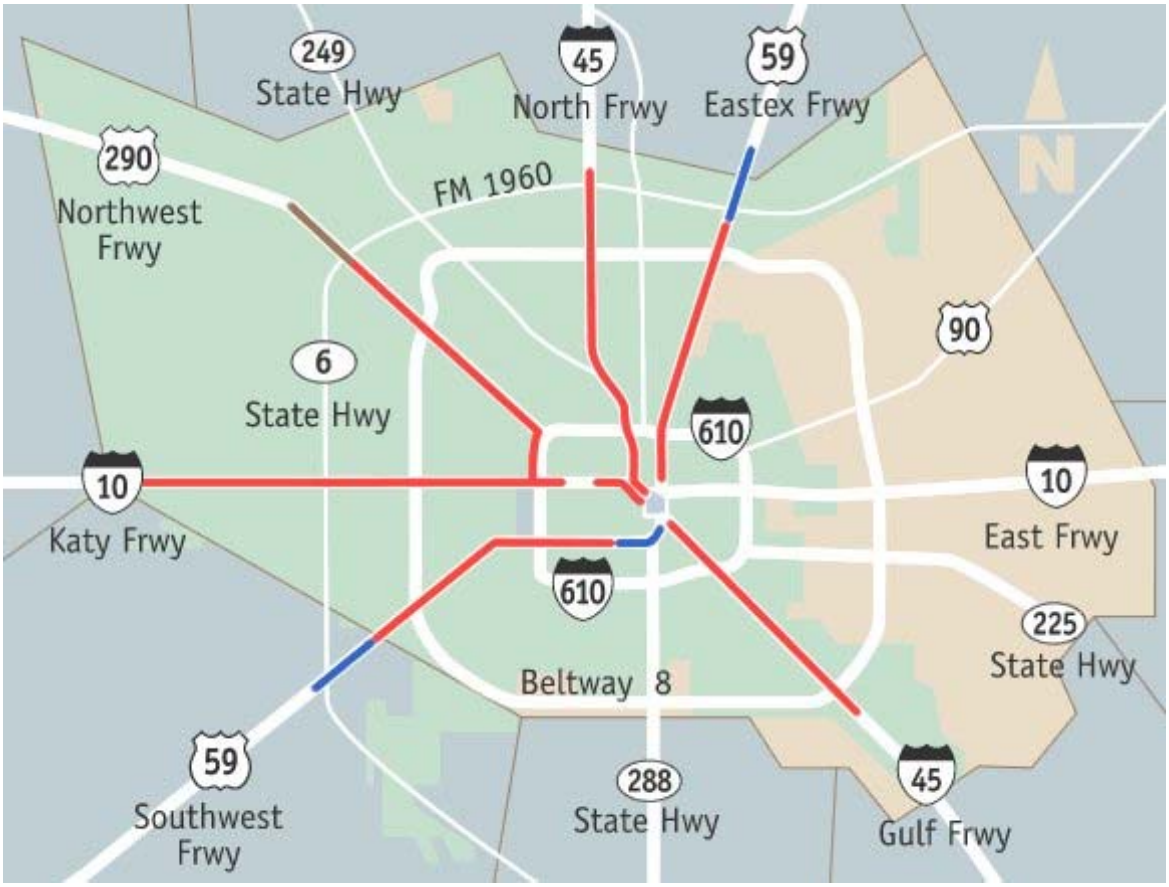

Figure 1: Houston's Network of HOV Lanes (source: Houston METRO

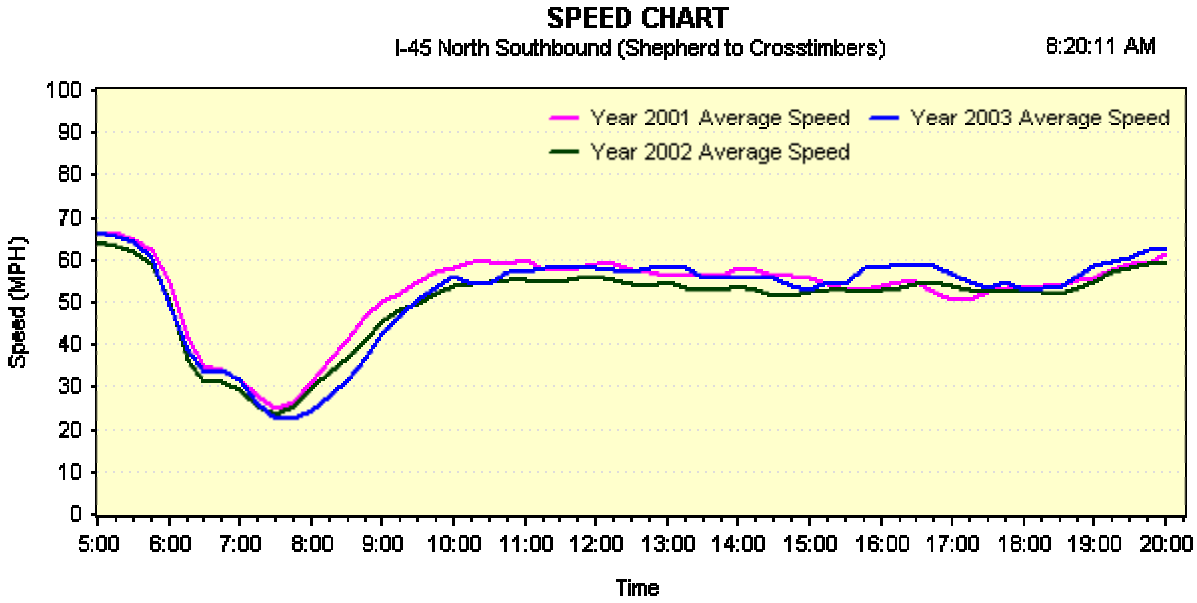

Figure 2: Average Travel Speeds on I-45 (Source: Houston TranStar)

The primary goal will be to optimize the use of the HOV lanes and the person-movement in the corridors through appropriate occupancy restrictions and tolling scenarios. This will result in a HOT network that capitalizes on the success of the HOT lanes already in Houston and the fact Houston travelers are already familiar with HOT lanes and toll roads. *A secondary goal will be the financial self-sufficiency of such a network*. For the long term stability of the HOT network it is important to develop a fiscally sound plan in which toll revenues will support initial costs and on-going operational costs, including enforcement (which can be one of the most costly items). This fiscally sound plan will detail methods to streamline HOT lane account management and management over the entire HOT network. This project will develop detailed equipment, signing, pricing, enforcement, legal, administrative, and financial specifications and plans to convert the entire HOV lane network into the optimal HOT network.

As discussed in section 1 of this proposal there are several scenarios under consideration when developing a HOT lane. The scenarios depend on the congestion experienced in the both the mainlanes and the HOV lane during all times of day. For example, the North Freeway experiences severe congestion on its mainlanes (see Figure 2) and some periods of less than free flow traffic on its HOV lane. As METRO and TxDOT have remained committed to the original goals of providing significant timesavings and trip reliability on the HOV lanes, the most likely course of action would be to raise the occupancy restrictions on this HOV lane during the peak period. At the same time, one plan could allow those travelers who were just restricted from using the lane to pay a toll and continue to use the HOV (now HOT) lane to make use of the excess capacity created with the new restrictions.

Another scenario may be that the freeway lanes are congested but the HOV lane is underutilized as on Eastex Freeway. In this case the HOV lane would be opened to lower occupancy vehicles willing to pay a toll.

This project will examine traffic conditions throughout the day on all six of these freeways (mainlanes and HOV lanes), with more effort focused on the four roadways (North, Gulf, Eastex, and Southwest) not already under study in the current Houston Value Pricing Project. Periods when the flow on the HOV lane is less than optimal will be targeted for HOT lane usage through appropriate pricing and occupancy restrictions. Pricing levels will be examined for each freeway on a case-by-case basis, keeping in mind (a) that allowing SOV access to the HOV lane necessitates dynamic pricing and (b) the maximum uniformity across all roadways will reduce user confusion and marketing expenses. Detailed equipment and enforcement specifications for each corridor will be developed as part of this project.

3. Social and Economic Effects of the Pricing Program

The economic effects in each corridor are likely to be modest as a maximum of 600 to 800 additional vehicles per hour can be accommodated on any of these HOV lanes. However, in the case where the HOV lane is opened to new users, the benefit to the new HOV lane users will be significant, as 2003 HOV lane evaluations show weighted average travel time savings of 19 minutes on the Katy HOV lane and 14 minutes on the Northwest HOV lane.

In the case where occupancy restrictions are raised, some drivers who previously used the HOV lane will need to either (a) pay the HOT lane toll, (b) find an additional passenger, (c) take transit, or (d) drive on the mainlanes. This will be a disbenefit to those travelers and their socio-economic characteristics should be investigated to determine if low-income travelers are being disproportionally impacted by these new occupancy restrictions and tolls. However, while a small number of travelers will be negatively impacted in this scenario, the majority of travelers on the HOV lane, including those taking public transit, will experience an improved level of service on the HOV lane. Therefore, overall equity impacts should be positive.

4. Role of Alternative Modes in the Project

The Houston HOV lane system carries significant bus and vanpool traffic and METRO continually evaluates service levels, both in quantity (buses) and operating speed. One of the key objectives of the pricing effort is to improve the efficient use of the HOV lane while maintaining a high level of service. In some cases this will involve increasing occupancy restrictions to improve flow on the HOV lanes. This, in turn, may encourage more transit ridership and additional carpooling. Additionally, the operating agreement between TxDOT and METRO specifies cost recovery and reinvestment in the corridor as the highest priorities for revenues.

5. Time-Line for Pre-Project Study and Implementation

This project will require 2 years to complete. After completion TxDOT, METRO, and HCTRA plan to implement the HOT network according to the specifications developed in this study. Please see item 6 (below) for specific timing of individual tasks.

6. Description of Tasks and Estimated Costs

Task 1. In concert with METRO, TxDOT and FHWA, a more detailed work plan will be developed that builds on the tasks listed below.

Task 2. Throughout this project, the project team will monitor and evaluate how already-proposed changes to the Katy and Northwest HOT lanes impact travelers, HOT lane usage, and traffic congestion. This information will be used to optimize many aspects of the plan for the other freeways in the HOT network (see task 7 below). Speeds will be collected on both the general-purpose lanes and on the HOT lanes using Houston's extensive automatic vehicle identification system (see http://traffic.houstontranstar.org/incmap/) and WaveTronix speed-flow measuring devices (installed in May of 2004) on the HOT lanes. These speed data will be used to

determine the travel time savings offered by the HOT lane (see Figure 3). Additionally, the number of HOT lane trips will be recorded and trends in usage will be examined (for example, see QuickRide Usage Analysis Report for 1998 to 2002, a report prepared as part of the current Houston Value Pricing Project. Note that a few of the documents prepared under the current pricing project are referenced in this proposal with hyperlinks to take readers directly to the document. These documents can be found at http://houstonvaluepricing.tamu.edu/reports/. Additional reports and papers on the current pricing project in Houston are available from the Texas Transportation Institute). Semi-annual violation studies, where the occupancy and QuickRide status of HOT lane users is observed and recorded manually, will be undertaken (for example, see Analysis and Classification of HOT lane violators)

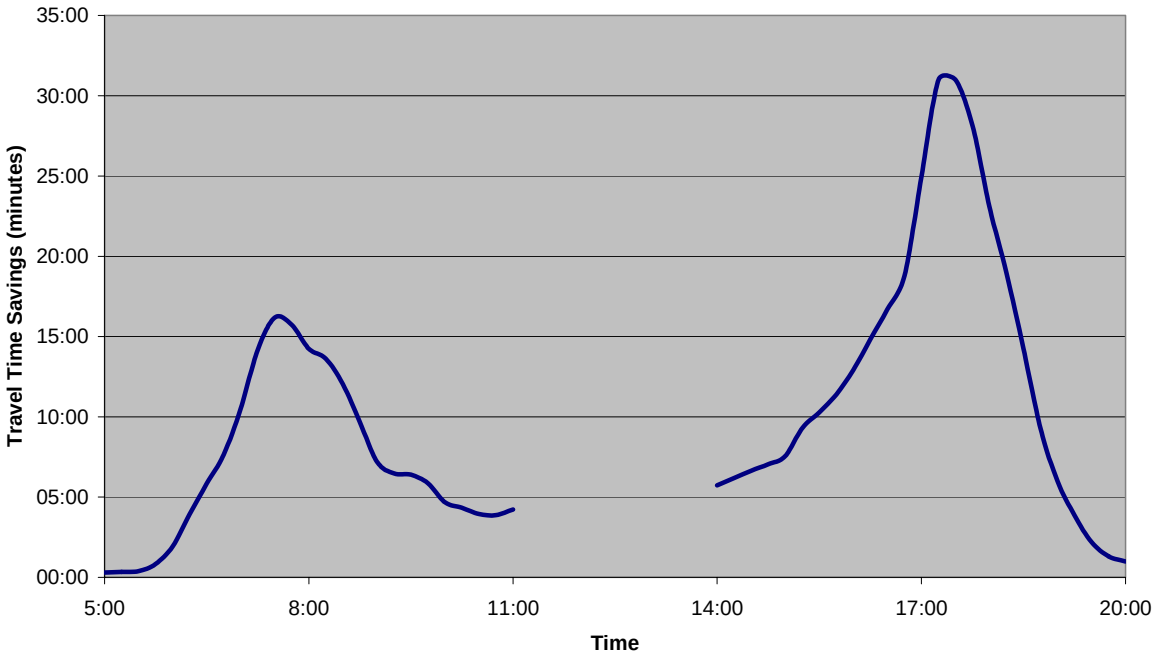

Figure 3: Travel Time Savings on Katy HOT Lane

Task 3. Collect data on the usage of the mainlanes and HOV lanes for all freeways in the HOT network. Collect data on traveler behavior, socio-economic characteristics, and stated preference to HOT lane use on the freeways without HOT lanes (much like the data collected on Katy and Northwest Freeways, see An Examination of Houston's QuickRide Participants by Frequency of Usage, and preliminary results from the Non-User Survey for examples). This will require surveys of travelers in at least two of those corridors. Develop pricing and occupancy scenarios to optimize the usage on each HOV lane and determine the size of the potential target markets. These pricing and occupancy scenarios will also include alternate scenarios in the event that travel trends (as monitored in this task and task 2) change significantly from historical trends.

Task 4. Develop and examine techniques and technologies for effectively enforcing Value Pricing without adversely affecting HOV lane flow. The task builds on what has been learned in the current Houston Value Pricing Project to further improve the complex issue of HOT lane enforcement (see Background Information: Enforcement Strategies and Approaches and Compliance Levels for examples). Detailed enforcement plans, with cost projections, will be developed for each freeway HOT lane. New technologies for automated occupancy enforcement will be investigated.

Task 5. Detail the required electronic toll collection technologies, reader locations, communications equipment, and transponder types required on each HOT lane. Efforts already undertaken, and resulting impacts on operations, for Katy and Northwest Freeways will be used as reference for this task (see Examination of Newly Installed Antennas, Pricing Network Assuming the Need for Dynamic Pricing, and Results of Non-Intrusive Detector Tests for examples).

Task 6. Develop strategies to more closely align enforcement efforts with cost recovery.

Task 7. Develop a detailed plan for back office operations to accommodate a substantial increase in size and complexity of the current HOT lane program. This will involve a plan to streamline operations to minimize cost per transaction and maximize the number of potential HOT network users. This plan will include cost estimates for the required changes in back office operations.

Task 8. Develop a signing plan that allows travelers to make informed decisions about usage of the HOT lanes. This plan will include signage requirements (number, size, location, and information to be displayed) for minimal and optimal signing plans. It will also include necessary steps, equipment, and anticipated costs to fully integrate the system into existing TranStar operations and will build on lessons learned and templates developed for the current QuickRide project (see Signing Location Plans for an example of the decision making process behind signage locations).

Task 9. Any legislative changes required for the development of the HOT lane network will be examined. This includes detailing the necessary steps to amend any current legislation that would prevent the implementation of HOT networks.

Task 10. Once the initial investigation of pricing scenarios (task 3) is well underway, present these scenarios to travelers to gauge their acceptance of the HOT network. Using this information the team will develop a plan for a public awareness campaign of the HOT network including advertising outlets and costs (see the Houston Value Pricing Program Brochure, and a recent PowerPoint presentation on the project.).

Task 11. Deliver a set of detailed plans that encompass all the necessary steps to implement an optimal HOT Network.

Table 1 indicates the approximate cost and anticipated timeframe for each of the above tasks.

Table 1: Costs and Timeframes for Houston HOT Network Project Tasks

Task	Estimated Timeframe	Estimated Cost
1. Develop Work Plan	Month 1	$10,000
2. Monitor Current (Katy and Northwest) HOT Lane Usage	Months 1 to 23	$25,000
3. Develop Pricing and Occupancy Scenarios	Months 2 to 18	$250,000
4. Enforcement Techniques	Months 6 to 22	$50,000
5. Toll Equipment Specifications	Months 6 to 22	$50,000
6. Enforcement Efforts and Cost Recovery	Months 6 to 22	$25,000
7. Back Office Operation Strategy	Months 9 to 22	$25,000
8. Signing Plan	Months 12 to 22	$50,000
9. Investigate Legislative Issues	Months 2 to 6	$50,000
10. Public Awareness Campaign Specifications	Months 16 to 23	$25,000
11. Detailed Houston HOT Network Specifications	Months 23 to 24	$15,000
TOTAL	24 months from notice to proceed.	$575,000.00

7. Plans for Monitoring and Evaluating the Project Elements

The bulk of this project is focused on developing detailed operating scenarios for the design of a HOT network and as such will not need detailed monitoring and evaluation. However, it will be important to monitor and evaluate how changes to the current HOT lanes on Katy and Northwest Freeways impact HOT lane users. Proposed changes include reduced shoulder period prices and dynamic pricing of SOVs in the off peak period. If one or both of these changes move forward the information gained from traveler responses to these changes will be valuable for Houston and other cities implementing HOT lanes. Additionally, the general trend in HOT lane users on the Katy as it undergoes reconstruction and on the Northwest Freeway as enforcement techniques are improved will prove to be valuable pieces of information as HOT lanes move forward. Additionally, any trends in HOT lane usage will be incorporated into the pricing and occupancy scenarios developed in task 3.

Therefore, METRO and TxDOT will engage a team of experienced universities to design and conduct evaluations of all aspects of the project, as well as document all phases of implementation to contribute to the overall knowledge base for value pricing (Tasks 2 and 3). It is anticipated that the team will be led by the Texas Transportation Institute of the Texas A&M University System. TTI has a long track record with the HOV system in Houston and extensive experience with pricing feasibility and evaluation. TTI has lead the effort on the current Houston Value Pricing Project and has extensive first-hand knowledge of Houston HOT lanes and the HOV network.

It is also anticipated that Texas Southern University will team with TTI to conduct the evaluations. Texas Southern, a historically black university located in Houston, has experienced professionals in both the transportation and planning departments that can contribute significantly to the project.

8. Detailed Finance and Revenue Plan

As part of this project a detailed finance and revenue plan will be developed for each HOT lane in the network. These plans will include costs for all enforcement, tolling, communication, pricing, etc. equipment, costs for back office changes, and anticipated toll revenues based on expected usage of the lanes. The plans will be developed with the goal of financial self-sufficiency for the program.

9. Stakeholder Inclusion and Outreach

Relationships with other transportation agencies are already in place, including a joint operating agreement between TxDOT and METRO for the HOV lanes and TxDOT, HCTRA, and METRO for the I-10 managed lanes. In addition to the MPO (Houston-Galveston Area Council), METRO and TxDOT will work with the Harris County Toll Road Authority (HCTRA) on opportunities of common interest, including areas such as combined administration of accounts.

10. Meeting Administrative and Legal Requirements

The Texas Legislature passed SB 370 during the 73rd Legislative Session that gave legal authority for TxDOT, toll authorities, transit agencies, and the private sector to participate in congestion pricing. TxDOT also had the authority, under section 224.154(a) or the Texas Transportation Code, to charge a toll on a facility with FHWA's approval.

METRO and TxDOT are active participants in the Houston-Galveston Area Council (HGAC), the local MPO, as well as a long-time recipient of both FHWA and FTA funds. As a result, they have in place appropriate mechanisms to ensure that all federal and state requirements are met. Furthermore, METRO and TxDOT are already participating in the Value Pricing program.

The HOV lane system and the HOT lane program are already MPO approved. The expansion and extension of Value Pricing will serve to further strengthen the value of the HOV lane network to the community.